

Safety Devices

(New Jersey probably had a more important role in the establishment and development of railroads than any other state in the country. This article, the twelfth of a series, deals with some of the devices and systems developed for greater safety in railroad transportation.)

NORTHERN RAILROAD OF NEW JERSEY officials sighed regretfully as they hauled the distinguished visiting signal engineer out of a snowbank beside the Northern's track on a crisp Winter morning in 1890. One look at the visitor's bleeding head convinced them that their automatic train stop was a dead number.

Sympathetic though they were, the Northern men couldn't help but wish he had kept his head down.

Minutes before there had been great enthusiasm as Northern's S. R. Har-

rington explained his device. It was simplicity at its best. A sash weight dangled from a semaphore arm as the arm dropped to denote danger ahead. If the train ran through the "stop" signal the sash weight struck a level atop the locomotive cab and applied the train's air brakes.

On the test run the visiting signal specialist took his work seriously. Deciding on a closer look, he scrambled up the coal in the tender as the locomotive sped toward the dangling weight.



A resounding "klunk" was the reward of the curious signal expert.

At what history records as precisely the wrong moment, he raised his head. Sash weights being what they are and heads being what they are, the result was inevitable.

Revived, the signal expert said many things, the expurgated gist of which was that Harrington's device wouldn't do.

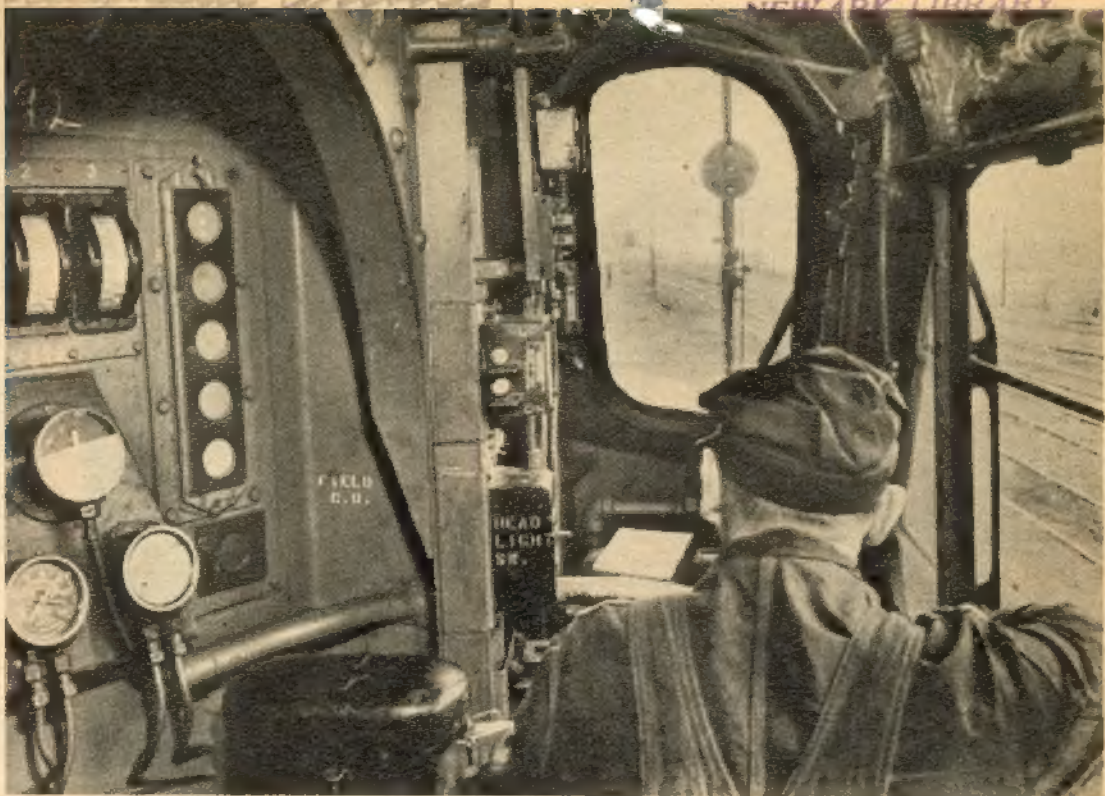
No, Harrington's device wouldn't do. For that matter, neither would

space rather than time best governs train movement.

As Welch conceived it (and as it is today), a "block" is a designated space to which only one train is entitled. The block may vary anywhere from a few hundred feet in length to several miles, but once a train enters a block no other train is permitted to move into the occupied block except under specific instructions.

BY the middle 1870s the basic components of modern safety systems were known. In 1872 a patent was issued for a battery-operated track circuit, to control signals automatically within a given block. At about the same time George Westinghouse was granted a patent for his air brake.

Still, railroads didn't immediately enjoy accident-free prosperity. For one thing, railroad stockholders didn't fall all over one another rushing to install safety devices. It was a recognized belief of the day that un-



All-weather device, shown as five-place panel to left of engineer, brings railside signals directly into Penn R. R. locomotive cab.

less something was "productive" it wasn't necessary.

Secondly, and perhaps most important, there was human failure. Railroads have never found an answer for that one.

Even with the block system, rear end collisions continued. Dispatchers occasionally forgot to notify someone ahead and engineers occasionally ran through signals. Sometimes telegraph systems broke down and sometimes telegraph operators forgot messages.

THERE is, for example, the true story of the telegraph operator who received a message to set a stop signal at the beginning of a block. He promptly forgot it. As a train high-balled past on the single track he suddenly remembered.

things didn't have to happen every day to stir railroad officials (especially with the public muttering unkind things in the background).

"Look," said railroad safety men. "We have the closed track circuit and we have the air brake. Let's marry them off and they should produce something to check any train which passes a 'stop' signal."

It was the attempt to bring off that marriage that enticed inventors like Harrington to the scene. He was just one of many—amateur and professional—working on the problem. By 1901 the automatic "tripper" stopping device was in use; in 1908 it was installed in the new tunnels of the Hudson & Manhattan Railroad.

The H. & M. still uses a "tripper"—

The Railroads Were Willing to Try Anything That Would Insure Accident-free Operation but Human Element Still Remains Prime Factor BY JOHN T. CUNNINGHAM

He checked his schedule with frantic fear. His most horrible thought was confirmed. Rushing in from the other end of the block was another train. Quickly he calculated—exactly 11 minutes until the inevitable head-on collision on the single track.

The telegrapher spent the rest of his days in a madhouse, counting up to 11.

The closed track circuit took the responsibility out of human hands by electrically setting the signals. That didn't stop an occasional engineer from ramming past a signal, however. Those were the days when men were men and often worked 'round the clock.

Men being men, sometimes one fell asleep at the throttle.

It didn't happen often, but such

the only railroad in the state to do so, for the very practical reason that snow and ice play havoc with the system in unprotected areas. Simply stated, the device works by having a mechanical arm strike a "tripper" on the train when a "stop" signal is passed. Air brakes are set and the train slams to a halt.

Word got about at the turn of the century that railroads were experimenting with automatic train control. The public was led to believe (by the inventors, generally) that such control was available but wasn't being installed because railroads were stingy.

Actually, however, it was recognized in engineering circles that such things as "trippers" would be dangerous on trains speeding at 60 or 70 miles per



The engineer's nose would tell him he had gone through a signal.



The Erie's "four-way" radio-telephone system is one of most progressive safety measures in the state. It operates between engine and ca-

hour. If such a sudden stop didn't buckle and derail the train, passengers would be slammed up against the end of the cars.

THUS, when the Interstate Commerce Commission set up its Block Signal and Train Control Board in 1906, it was looking for something which would first warn an engineer if he had passed a stop signal, then take over if he failed to respond.

The board studied 1,146 plans through 1912, but recommended none of them. They were varied and ingenious, although most breath-taking was the suggestion of a man from the Midwest.

NOTHING to it, wrote the Mid-Westerner. Put a skunk in a cage just ahead of the locomotive cab—facing forward, of course. Then, have a stick drop across the right-of-way when a signal says "stop." The stick strikes the skunk's cage and nature takes it from there.

No engineer with a nose could fail to realize he had gone through a block signal!

That one is actually in the archives, along with the government's straight-faced reply that it was sorry, but no funds were available to test the plan—notable though it was.

RAILROAD safety gained impetus after World War I. By then railroads had learned that safety and economical operation go hand-in-hand. They had learned that installation of an automatic block system could more than pay for itself by permitting more rapid movement of passengers and freight. Fewer accidents did wonders for both public relations and reduced claims against the lines.

The ICC entered the picture again in 1922 with an order directing 94 railroads to install automatic train stoppers on specified short runs of track. Their hope was that the railroads would see the merits of the system themselves and extend the systems.

One of the metropolitan area railroads did—the New York Central. Even today it uses a system of electromagnetic devices to control the train's air brakes. As long as the block signals are favorable, the train rolls unfettered. However, let a "stop" signal be ignored and a whistle gives the engineer 15 seconds to control the train. If he doesn't take over in that time the brakes are applied automatically for an emergency stop.

THE Pennsylvania Railroad sought and found a different answer—the cab signal, whereby all rai-side signals are reproduced in the cabs on a panel

in front of the engineer. Supplementing the visual signals is a bell or whistle which sounds automatically with each change of signal, and keeps sounding until the engineer shuts it off.

Also intently checking the sound is the engineer's assistant. If the whistle continues more than six seconds he must investigate to determine why and follow the signal if the engineer can't.

It goes beyond that. Pennsylvania rules require that the engineer and his assistant verbally acknowledge to each other a change in signals.

When the cab signals were first tried in 1927 the ICC insisted that an automatic stopping actuator also be used, to apply the brakes at the end of six seconds. That rule was relaxed in 1932.

CAB signals reflect the condition of the road ahead in terms of the automatic block system. As soon as a train enters a block it sets a "stop" in the block immediately behind and a "caution" in the block behind that.

Determination of the length of a block is always based on the worst possible conditions, to insure plenty of space in which a train can be stopped. Accordingly, a signal permits full braking even if the rails are



boose, between passing trains and is used for communication with way-side stations. Power for system is supplied by axle-driven generator.

iced, the grade downhill, the train particularly long or heavy or any other unusual condition. Naturally if a train can be stopped readily under the worst situations, it can be easily controlled in normal operation.

All railroad safety is based on any failure being "on the safe side." A power failure or rail break sets all block signals on "stop" automatically. Inside the cabs of electric and Diesel engines, unique "dead man" controls take over if the engineer is stricken.

On electric engines the engineer must keep a pin in the throttle depressed at steady pressure. Even a momentary lapse of attention can set the brakes—and once the action starts it carries through. The same is true on Diesels, although the "dead man" control is usually a foot pedal.

SLIGHTLY more than a month ago a Page One story in The News told of a "dead man" control bringing a crowded rush-hour Lackawanna Railroad train to a screeching halt just west of Bergen Tunnel when a 56-year-old engineer collapsed and died at the throttle.

That business of "failing on the side of safety" applies to air brakes as well. It would have been simpler, perhaps, to have planned the system so that an increase of air pressure

would apply the brakes. Instead, air pressure is kept applied at all times and brakes are set by releasing air pressure. Accordingly, even if the air should suddenly bleed from the system the result is application of brakes rather than an absence of them, as, for example, when hydraulic fluid escapes from an automobile braking system.

Safety factors go far beyond signals and automatic train stops, of course. Every effort is made to minimize danger, if for no other reason than the simple economic fact that safety means money.

COMING into the story as a regulating agency is the Public Utilities Commission, whose regular inspection of roadbed, track, bridges, grade crossings, ties and ballast helps spur the railroads to provide and maintain good operating conditions.

The most modern electronic gadgets are employed by railroads in checking their countless miles of steel rails. A special "detector car" like that invented in 1927 by Elmer A. Sperry (of gyroscope fame) travels slowly over New Jersey rails, shooting electrical impulses into the steel. Any defect in the rail sets in motion a machine which simultaneously sprays white paint over the defective piece of rail and also records the defect on a tape inside the car. No train may cross the defective rail until it is replaced.

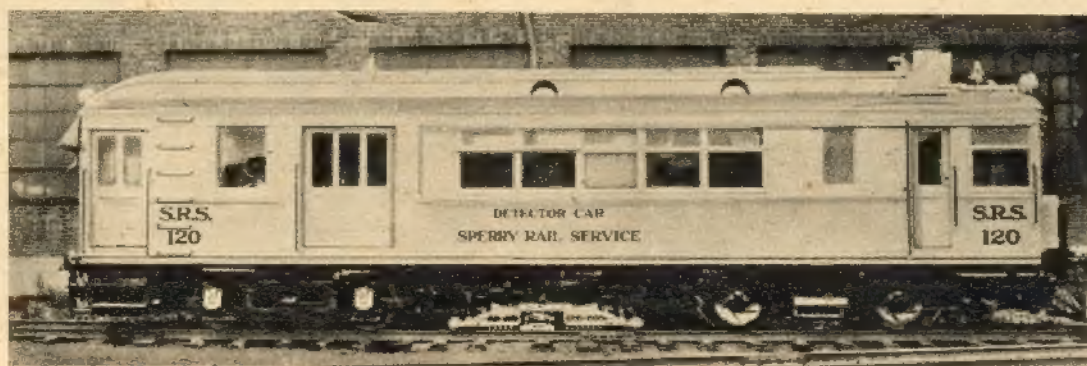
Electronic devices are also used in many terminals before a train starts its run, to check wheels and axles for hidden flaws. Meanwhile, the car inspector peeks into journal boxes to see if they are properly packed and taps wheels and axles with a hammer and listens for flaws. He checks the air brakes before the train leaves the home terminal and every time cars are added or detached.

HONORED above all else in railroads is TIME; nothing so symbolizes accuracy as the railroad man's watch.

No watch may vary more than 30 seconds per week from the time signal of the U. S. Naval Observatory in Washington. Regular inspections insure there are no variances. Every one from engineer to foreman of track gangs carry such synchronized time pieces, and one of railroading's most familiar sights is that of the engineer and the conductor comparing watches before a train run.

The duties of every operating railroad man are governed by extensive rules which he is required to study and learn. The rules cover everything from speeds on all parts of his railroad, including curves, to long-

(Continued on Following Page)



Most modern electronic device used by railroads to check miles of steel rails is the Sperry "detector car." Tape recorder in lower right registers perfect rails during a test run while another member of crew checks position of a recorded hidden flaw.



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New High-Lustre Laco is mild,
mild...a 100% pure Castile
Shampoo that is guaranteed to
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thetic detergents and so...can
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(Cont'd from Preceding Page)

standing Rule 99, which provides for the protection of the rear of a standing train in much the same way as such protection was afforded 100 years ago.

As soon as a train comes to more than a temporary pause, the engineer touches his whistle or air horn—a long blast, then three short ones.

That has always meant "Flagman protect rear of train."

OFF the flagman hustles to observe Rule 99, going "as far back as necessary" to protect his train. He attaches one or two torpedoes to the track, perhaps lights a fuse (bright flare) or stays to flag oncoming trains. Actually, in today's high speed train era Rule 99 is only a secondary precaution at best, but most railroads seldom drop a safety rule once it is established. The more the safer.

One of the state's most progressive safety measures is the Erie's "four-way" radio-telephone system, now installed on more than 90 per cent of the Erie's main line from Jersey City to Chicago.

The "four-way" operations are between engine and caboose, between passing trains, between trains and wayside stations and between adjacent wayside stations. Possibly the most important, from a safety angle, is the communication between passing trains with crews on the lookout for hot journals and

other things which might cause trouble. Obviously radio is vital in train control, which in turn underlies operating safety.

Many railroads have been supplementing all other regulatory factors with Centralized Train Control (C. T. C.). Under C. T. C. an operator or dispatcher in a terminal or division point exercises complete control over all switches and signals through an extended piece of railroad—as much as a whole division with hundreds of miles of track. Every movement of a train on his controlled stretch is automatically and continuously shown on a panel board before him.

Yet, despite block signals, cab signals, air brakes, synchronized watches, ballast cleaning machines, train orders, C. T. C., car inspectors, radio and all the rest, a train barrels along out on Long Island on a Thanksgiving Eve and kills 75 persons in a rear end crash. Another twists off a track at Woodbridge and takes 84 lives.

Why?

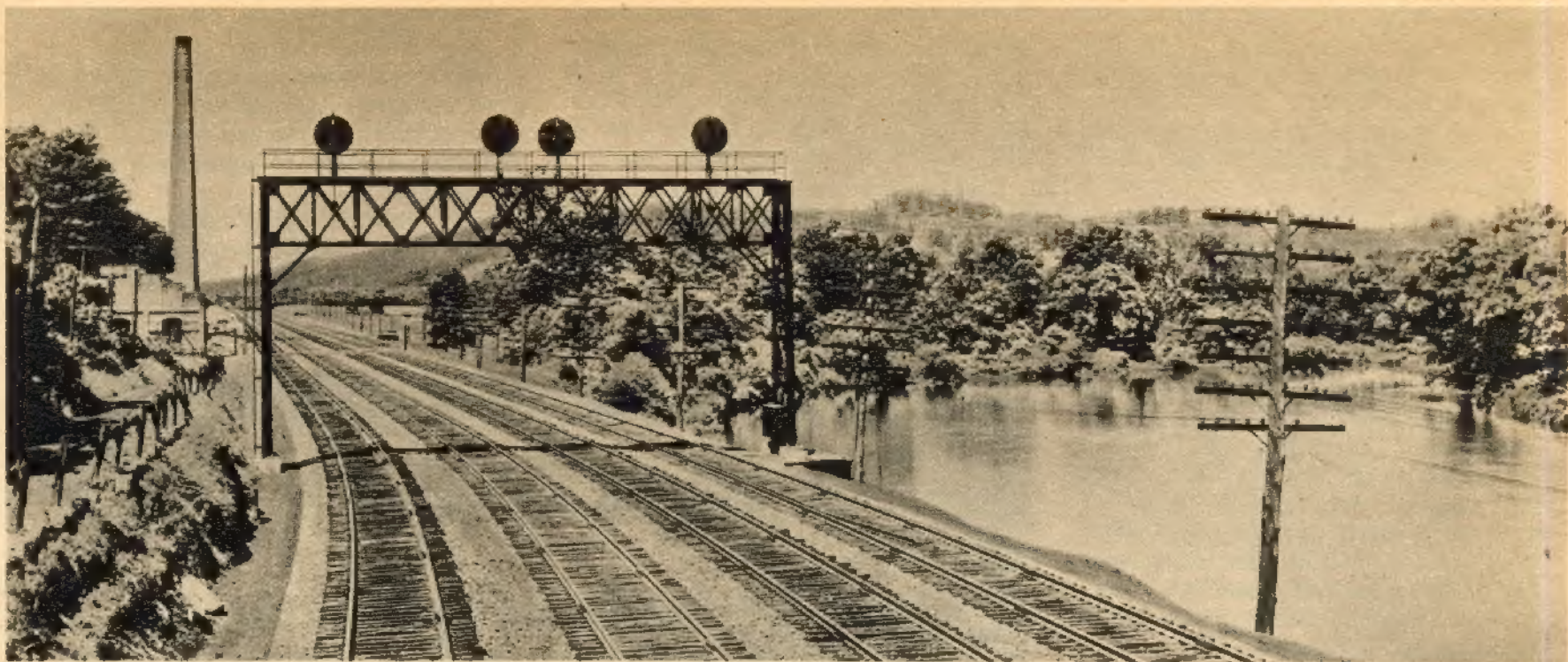
Apparently because of the one thing railroading hasn't overcome—the human factor, whether it be human judgment that fails to recognize the need for safety measures at a given point or the human who fails to abide by such safety aids which are present to guide him.

JERSEY RAILROADS---Safety Devices

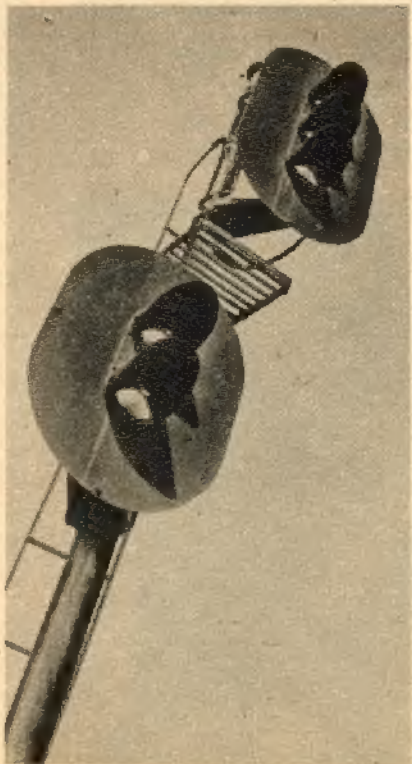


Conductor and engineer synchronizing watches.

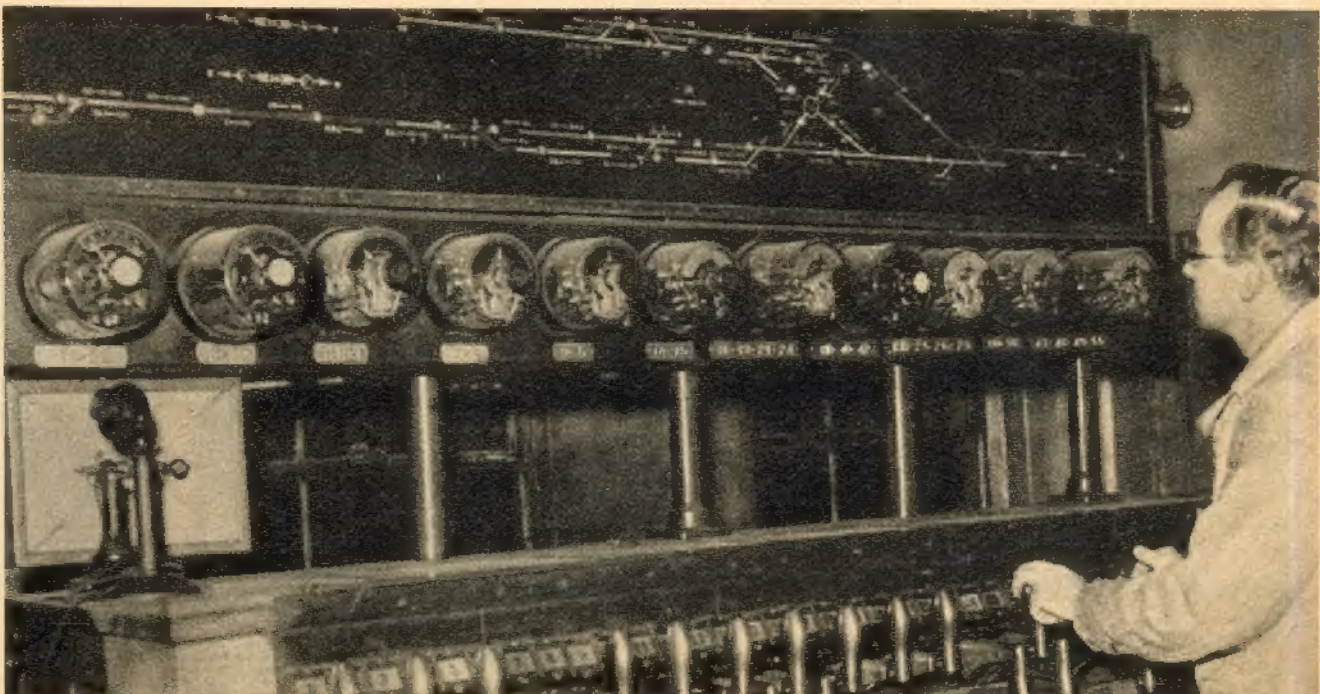
Next Week—When Railroad Was King



Modern signals and rock ballasted roadbed along the Lehigh Valley Railroad.



A railroad's "eyes."



Control operator watches panel showing the positions of switches and signals.